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Claims

1. A unipolar transverse flux machine, having a rotor (12) rotatable about a rotor axis (19), which rotor has at least one rotor module (15) each assembled from two coaxial ferromagnetic rotor rings (16, 17) toothed with a constant tooth pitch and one permanent-magnet ring (18) fastened between the rotor rings (16, 17) and magnetized unipolarly in the direction of the rotor axis (19), and having a stator (11), concentric with the rotor axis (19), which stator has at least one stator module (14) associated with the rotor module (15), which stator module comprises an annular coil (23; 23') disposed coaxially to the rotor axis (19) and U- shaped stator yokes (24), fitting over the annular coil, which are fixed with a pitch corresponding to the tooth pitch on a housing (10), characterized in that the toothing of the rotor rings (16, 17) is provided solely on the outer circumference of the rotor rings (16, 17) remote from the rotor axis (19); that in the stator module (14), the stator yokes (24) are disposed such that one leg (241) of each of the stator yokes (24) is located facing one rotor ring (16), and the other leg (242) of each of the stator yokes (24) is located facing the other rotor ring (17), in each case with a radial gap spacing; and that one short-circuit element (25; 25') each is disposed between successive stator yokes (24) in the direction of rotation of the rotor (12), which short- circuit element extends axially over both rotor rings (16, 17) and faces them with radial gap spacing.

2. The machine of claim 1, characterized in that the rotor (12) has two identical rotor modules (15), and the stator (11) has two identical stator modules (14), and that the stator modules (14) are firmly seated axially side by side in a housing

(10) and the rotor modules (15) are firmly seated axially side by side on a rotor shaft (13), each in a mutual relationship, such that the stator modules (14) or the rotor modules (15) are each rotated electrically from one another by 90°.

3. The machine of claim 1, characterized in that the rotor (12) has m rotor modules (15), and the stator (11) has m stator modules (14), and that the stator modules (14) are firmly seated axially side by side in a housing (10) and the rotor modules (15) are firmly seated axially side by side on a rotor shaft (13), each in a mutual relationship, such that the stator modules (14) or the rotor modules (15) are each here [verb missing] electrically from one another by 360°/m, where m is an integer and is greater than 2.

4. The machine of [one of claims 1-3] claim 1, characterized in that the stator yokes (24) and short-circuit elements (25; 25') as well as the rotor rings (16, 17) are laminated.

5. The machine of [one of claims 1-4] claim 1, characterized in that the short-circuit elements (25; 25') are disposed with an offset of one pole pitch from the stator yokes (24).

6. The machine of [one of claims 1-5] claim 1, characterized in that the radial gap spacing between the stator yokes (24) and the rotor rings (16, 17), on the one hand, and between the short-circuit elements (25; 25') and the rotor rings (16, 17) on the other is of equal size.

7. The machine of [one of claims 1-6] claim 1,

characterized in that the free end face (244) of the legs (241, 242) of the stator yokes (24) has at least the same axial width as the rotor rings (16, 17), but preferably protrudes past them on one or both sides.

8. The machine of [one of claims 1-7] <u>claim 1</u>, characterized in that the width of the stator yokes (24) and the width of the short-circuit elements (25; 25'), measured in each case in the direction of rotation, is approximately equal.

9. The machine of [one of claims 1-8] <u>claim 1</u>, characterized in that the ratio of the tooth width (b_{ZR}) of the teeth (22) on the rotor rings (16, 17) to the width (b_{ZS}) of the stator yokes (24) and short-circuit elements (25), each viewed in the direction of rotation, is selected to be greater than 1 and less than 2, and preferably equal to or less than 1.5.

10. The machine of [one of claims 1-9] <u>claim 1</u>, characterized in that the short-circuit elements (25) are in the form of a C, with two short legs (251, 252) each radially facing a rotor ring (16, 17) and with one crossbar (253), connecting the legs to one another, that extends parallel to the rotor axis (19) on the inside, toward the rotor axis (19), of the annular coil (23), which is embodied circularly.

11. The machine of [one of claims 1-9] <u>claim 1</u>, characterized in that the short-circuit elements (25') are in the form of a U, each with two long legs (251', 252') radially facing a rotor ring (16, 17) and with one crossbar (253') connecting these long legs and extending parallel to the rotor axis (19), and that the annular coil (23') of the stator module (14) is shaped in meandering fashion, point-symmetrically to the rotor

axis (19) in the radial plane, in such a way that in successive alternation the annular coil extends through the space between the legs (241, 242) of a stator yoke (24) and beyond the outside, remote from the rotor axis (19), of a crossbar (253') of a short-circuit element (25').

12. The machine of claim 11, characterized in that the stator yokes (24) and short-circuit elements (25') are embodied identically.

13. The machine of [one of claims 10-12] claim 10, characterized in that the free end face (254 and 254', respectively) of the legs (251, 252 and 251', 252') of the short-circuit elements (25 and 25') have at least the same axial width as the rotor rings (16, 17), but preferably protrude past them on one or both sides.

14. The machine of [one of claims 1-13] claim 1, characterized in that the stator modules (14) are supplied with current in current pulses bipolarly as a function of the rotational angle (Θ) of the rotor (12), and that the current pulses in the stator modules (14), when there are two stator modules (14), are phase-displaced by 90° from one another, and when there are m stator modules (14) they are phase-displaced from one another by 360°/m, where m is an integer and is greater than 2.

15. The machine of [one of claims 1-14] claim 1, characterized in that each stator module (14) is received in a housing (30) that comprises two half shells (31, 32), which are embodied identically and placed on one another mirror-symmetrically and which have axially aligned radial grooves (36,

37) for insertion of the stator yokes (24) on the one hand and the short-circuit elements (25) on the other and also have indentations (39), for receiving the annular coil (23), that face one another mirror-symmetrically and are oriented concentrically to the housing axis (38).

16. The machine of claim 15, characterized in that each half shell (31, 32) has a gridlike structure with an inner ring (33) and an outer ring (34) concentric to it, which are integrally joined to one another by radial ribs (35), and that the radial grooves (37) that receive the short-circuit elements (25) are placed in the inner ring (33), and the radial grooves (36) that receive the stator yokes (24) extend across the inner ring (33), radial rib (35), and outer ring (34).

17. The machine of claim 16, characterized in that the indentations (39) for the annular coil (23) are made in the radial ribs (35).

18. The machine of [one of claims 15-17] claim 15, characterized in that the stator yokes (24) and the radial grooves (36) that receive them are adapted to one another such that when the stator yokes (24) and short-circuit elements (25) have been inserted into the radial grooves (36, 37), the two half shells (31, 32) are fixed against one another radially and axially nondisplaceably.

19. The machine of claim 18, characterized in that the width of the radial grooves (36, 37) is adapted to the thickness of the stator yokes (24) and short-circuit elements (25), and the axial depth of the radial grooves (36, 37) is dimensioned as slightly larger than half the axial width of the stator yokes

(24) and short-circuit elements (25).

20. The machine of claim 18 [or 19], characterized in that the stator yokes (24), on both sides of their crossbar (243), have a respective protruding hook (41), which when the stator yokes (24) have been inserted into the radial grooves (36) fits by positive engagement over one radial rib (35) of the two half shells (31, 32), on its back side remote from the radial groove (36).

21. The machine of claim 20 in a multi-lane version, in which the rotor modules (15) are disposed in axial alignment on the rotor shaft (13) and the stator modules (14) are rotated by a fixed angle relative to one another, characterized in that two spaced-apart radial recesses (42, 43) are inserted, from the outsides of the half shell (31) that are remote from the radial grooves (36), into the annular portions (341) of the outer ring (34) that extend between the radial ribs (35), the width of the radial recesses in the circumferential direction corresponding to the width of the hooks (41) that protrude from the stator yokes (24), and the radial depth of the radial recesses corresponding to the axial length of the hooks (41), and that one radial recess (43) is disposed offset by the fixed rotational angle from the next radial groove (36) in succession for a stator yoke (24), and the other radial recess (44) is disposed offset by the same fixed angle from the preceding radial groove (36) for a stator yoke (24).

22. The machine of claim 18 [or 19] in a multi-lane embodiment, in which the stator modules (14) are axially aligned and the rotor modules (15) are disposed, rotated relative to one another by a fixed angle, on the rotor shaft (13), characterized

in that the stator yokes (24) of the stator modules (14') located side by side in the axial direction are joined together in their crossbar region by axially extending bridges (48); that on their outer side, the two outer stator yokes, of the joined-together stator yokes (24) each have one hook (41) protruding from the crossbar (243), which hook, when the stator yokes (24) have been inserted into the radial grooves (36), fits over a radial rib (35) of the two outer half shells (31, 32) on its back side remote from the radial groove (36).

23. The machine of claim 22, characterized in that the stator yokes (24) joined together via bridges (48) are embodied as one-piece stamped parts (49).

24. The machine of [one of claims 20-23] claim 20, characterized in that on the end, located in the outer ring (34), of each radial groove, a radial recess (42) is made in the groove bottom, the radial depth of which recess is dimensioned such that when the stator yoke (24) has been inserted in the correct position into the radial groove (36), the root (411) of the hook (41) protruding from the crossbar (23) strikes the bottom of the recess (42) with its lower edge pointing toward the inner ring (33).

25. The machine of [one of claims 15-24] claim 15, characterized in that for rotational support of the rotor shaft (13), two bearing plates (45) are placed on the two outer half shells (31, 32), which plates are secured to the half shells (31, 32) with a flange part (46) and receive the rotor shaft (13) in a bearing prop (47) protruding from the flange part.

26. The machine of [one of claims 1-25] claim 1,

characterized in that the at least rotor module (15) is disposed, fixed against relative rotation, on a hollow shaft (50).